

# PATENT SPECIFICATION

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## (54) CHAMBER FILTER PRESS

- (71) We, EBERHARD HOESCH & SOHNE, a German Kommanditgesellschaft of Postfach 116, Teischstrasse, 516 Duren, Federal Republic of Germany, do hereby declare the invention for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- 5 The invention relates to a chamber filter press having a plurality of filter plates consisting of chamber plates and diaphragm plates following one another alternately, with a turbid liquid duct passing through all the filter plates and formed by a bore arranged in each filter plate.
- 10 In a known chamber filter press of the type initially specified the turbid liquid duct composed of the bores arranged in each filter plate passes in the longitudinal direction through the entire set of plates. The filter chambers formed between each two plates lying against one another are each intersected by the turbid liquid duct.
- 15 The filter chambers are sealed at the edge and also at the passage regions by corresponding encircling sealing edges which are pressed against one another by the closing pressure acting on the plate assembly. The intersections in the chambers by the liquid duct form a construction problem for the securing or the filter cloth but more particularly for the construction of the membranes which cover the diaphragm plates. Owing to the variable geometry of the filtering level these membranes must be particularly elastic at these regions. But it must be absolutely sealing-tight relatively to the filtration pressure and the usually substantially higher pressure of the pressure medium. Because the intersections in the chamber are situated in the region of the chamber interior (and in all cases where the turbid liquid duct is not arranged in a centrally symmetrical manner) these regions where intersections occur are subjected to non-symmetrical expansion when a pressure medium is introduced into the chamber. Further-  
 50 more these regions are subjected to alternating forces during operation, which results in shortening the working life of the membranes. Since in the region of the intersections the filter cloth lying on the membrane also has to be secured and sealed, the movements of the membrane also transmit high tensile forces to the filter cloth and its fixing means.
- 55 The invention has as an object to provide a chamber filter press of the type initially specified whose turbid liquid duct is so constructed that the freedom of movement of the membrane of the diaphragm plates is not prejudiced and both the membrane and also the applied filter cloth are subjected to uniform load during pressing or during the washing operation over the entire filter surface.
- 60 According to the invention there is provided a chamber filter press comprising face-to-face oriented, alternately arranged chamber plates and diaphragm plates co-operating together to form filter chambers therebetween, each plate having a frame portion and a centre plate extending inwardly of the frame portion, each chamber plate having a tapering transitional portion connecting the frame portion with the centre plate, a throughgoing bore provided in the frame portion of each plate and being in alignment with one another to constitute a turbid liquid channel passing through all the plates, a port extending through the frame portion of each chamber plate for maintaining communication  
 70 between the bore and two filter chambers one on each either side of the centre plate of the respective chamber plate and defining an inlet to the said two filter chambers, each port having outlet openings disposed in said tapering transitional portion of each chamber plate, filter cloths oriented face-to-face with respect to the centre plates of the chamber plates on each side thereof,  
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respective orifice members inserted into each outlet opening at either side of the respective centre plate, each orifice member constituting a part of said port, and means for releasably tightening to one another the said orifice members in each chamber plate so that the filter cloths are clamped by the orifice members to the respective chamber plate.

As a result the turbid liquid inlet is arranged only in the chamber plate, that is to say the plate which is covered only with a filter cloth, whereas the diaphragm plates are completely free over the entire filter surface of any prejudicial factor which would be involved by a through bore or a channel taken through them.

The outlet aperture of the turbid liquid inlet into the filter chamber, being arranged in each case in the transition region between frame part and centre plate of a chamber plate, ensures that the turbid liquid duct enters the filter chamber through a portion of the plate which is substantially thicker than the centre plate.

According to a particularly advantageous form of the invention it is proposed that the orifice members are inserted detachably and in such a manner that they can be clamped to the respective chamber plates at the outlet aperture of each turbid liquid inlet entering the respective chambers. By means of this kind of orifice member on the one hand a deliberate guiding of the flow of turbid liquid entering a chamber can be effected by suitable formation of the orifice member. On the other hand by means of this the filter cloth can be securely fixed at edges of the aperture in this region.

In an advantageous feature of the invention it is also proposed that the orifice member comprises in each case a flange with an abutment surface which extends at an inclination to the axis of the aperture and encircles the aperture, the said surface being associated with a geometrically correspondingly shaped associated surface in the chamber plate. This makes it possible to provide a satisfactory seal and to secure the filter cloth in a satisfactory manner in the region of the turbid liquid inlet. It is particularly advantageous if the inclination of the associated surface in the chamber plate is made slightly larger than the inclination of the abutment surface of the flange. In this way it is ensured that at least in the external edge region of the flange the filter cloth is clamped securely between the orifice member and the chamber plate. It is particularly advantageous if according to the invention the orifice member is made capable of deformation at least in the region of the abutment surface.

One arrangement according to the invention will now be described by way of

example with reference to the accompanying diagrammatic drawings.

In the drawings:—

Figure 1 shows a diagrammatic view of a chamber filter press having a plurality of filter plates;

Figure 2 shows a plan view of a so-called chamber plate;

Figure 3 shows a partial section taken along the line III in Figure 2, showing the construction of a set of filter plates within the filter press;

Figure 4 shows a section through the turbid liquid inlet of a chamber plate on a larger scale.

As Figure 1 shows, a plurality of filter plates are held in a machine frame 1 in such a manner that they can be displaced horizontally. By means of a driving arrangement provided with latches 3 the filter plates can be moved individually into the open position when the press closure member 4 is withdrawn. A filter-cloth 5 is suspended from means 5' between individual plates so as to provide a double thickness which is opened out to allow discharge of the filter cake when the filter plates are separated, suspension means 5' being guided in the upper machine frame. Arranged at the end of the frame remote from the closure member 4 is a connection union 6' for the entry of turbid or untreated liquid. Situated in line with the union 6', in each filter plate, is a bore so that with the filter closed there is provided a turbid liquid duct 6 extending through the entire set of plates. At their underside the individual filter plates are provided with outlet apertures, not shown here, for the filtrate, these apertures being provided with a valve and opening into a collecting channel 7 from which the clear filtrate is removed by means of the filtrate outlet 8.

In the filter press the plates comprise alternately so-called chamber plates and diaphragm plates. The chamber plates 9 consist, as is shown in Figure 3, of a frame part 10 and a so-called centre plate 11, which is made correspondingly thinner. A filter cloth 12 is mounted at both sides on the chamber plate.

The diaphragm plate 13 in its external form is of corresponding construction, that is to say it also has a frame part 14 and a centre plate 11 and has a filter cloth mounted on both sides. But in contrast to the chamber plate the diaphragm plate is covered with a membrane 15 of an elastic material on which a filter cloth is externally secured. By means of ducts not shown in Figure 3 the membrane can be lifted from the corresponding centre plate 11 by introducing a pressure medium to the duct, for example air, and pressed against the adjacent chamber plates. By further ducts

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which are also not shown and which open between the membrane and the filter cloth, it is also possible by introducing a washing liquid to wash the filter cake after a first filtration step. In Figure 2, which shows a view on to a chamber plate, there are shown ducts 16 which are for the washing liquid and ducts 17 which are for filtrate removal. These ducts extend like the turbid liquid duct 6 through the entire set of plates.

The turbid liquid inlet into each filter chamber is formed by a bore 18 which is situated in the frame part 10 of each chamber plate. Bore 18 communicates with the turbid liquid duct 6 and guides the stream of turbid liquid by way of respective orifice members 19 in the opposite sides of the plate into the two adjacent chambers. As is seen in connection with Figure 2 and Figure 3, this arrangement has the result that all the ducts opening into the filter chamber are situated in regions of the chamber plate which lie away from the sealing regions 10, 14 thereof. The ducts in the diaphragm plates are similarly organised. It is also to be noted that the membrane of the diaphragm plate can be moved uniformly over the entire surface of the respective centre plate during the pressing operation without being hindered by any perforations, so that it and the overlying filter cloth are subjected to uniform stress distribution and thus their working life can be improved. This is especially true of the filter cloth, this cloth being only elastic to a small extent in comparison with the membrane.

In the chamber plates also important advantages are obtained as regards the sealing and fixing of the filter cloth, since the manner in which the inlet duct is arranged means that in the region of the sealing surfaces of the frame parts 10 there are no kinds of restrictions or projections which would disturb the smooth line of the applied filter cloth, so that here again uniform distribution of stresses is ensured for the filter cloth during the filtering operation.

Figure 4 shows on a larger scale the arrangement of the inlet 18 in the frame part 10 of a chamber plate and also the arrangement of the orifice members 19. The turbid liquid inlet 18 is constructed substantially as a rectangular duct which extends in the plane of the centre plate 11 in the frame part 10. In its region adjoining the frame part the centre plate comprises at this zone an aperture into which the orifice members 19 are inserted from both sides and are clamped against one another by two clamping screws 20. The orifice members 19 each have an encircling flange which is arranged at an inclination in relation to the axis of the particular passage in the orifice

members and with which there is associated a correspondingly inclined abutment surface on the chamber filter plate. The filter cloth 12 is clamped securely between the flange surface and abutment surface by the orifice members which are clamped relatively to one another. If the inclination of the associated surface in the chamber plate is made slightly greater than the inclination of the abutment surface of the flange, this ensures that the flange reliably bears fully at its external edge region on the filter cloth and thus ensures uniform clamping of the filter cloth.

The clamping effect can be further improved if the orifice members is made capable of deformation at least in the region of the abutment surface. A similar result can be achieved by interposing an additional elastic element between the orifice members and the chamber plate.

The diaphragm plate may also be constructed that it does not have a rigid centre plate and the two membranes though remaining essentially deformable are rigid enough to provide the supporting function of the centre plate during operation. A transition in the membranes in the region of the inside edge of the diaphragm plate frame provides additional flexibility in this region.

#### WHAT WE CLAIM IS:—

1. A chamber filter press comprising a face-to-face oriented, alternately arranged chamber plates and diaphragm plates co-operating together to form filter chambers therebetween, each plate having a frame portion and a centre plate extending inwardly of the frame portion, each chamber plate having a tapering transitional portion connecting the frame portion with the centre plate, a throughgoing bore provided in the frame portion of each plate and being in alignment with one another to constitute a turbid liquid channel passing through all the plates, a port extending through the frame portion of each chamber plate for maintaining communication between the bore and two filter chambers one on each side of the centre plate of the respective chamber plate and defining an inlet to the said two filter chambers, each port having outlet openings disposed in said tapering transitional portion of each chamber plate, filter cloths oriented face-to-face with respect to the centre plates of the chamber plates on each side thereof, respective orifice members inserted into each outlet opening at either side of the respective centre plate, each orifice member constituting a part of said port, and means for releasably tightening to one another the said orifice members in each chamber plate so that the filter cloths are

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clamped by the orifice members to the respective chamber plate.

5 2. A chamber filter press according to Claim 1, wherein each orifice member includes a throughgoing opening having an axis and a flange having an engagement face inclined with respect to said axis and wherein each chamber plate has a counterface contacting the engagement face of the flange.

10 3. A chamber filter press according to Claim 2, wherein the inclination of said counterface with respect to said axis is slightly greater than that of said engagement face of said flange.

15 4. A chamber filter plate according to Claim 3, wherein each orifice member is

made of a deformable material at least in the zone of the engagement face.

5. A chamber filter press according to any 20 of claims 2 to 4, wherein said securing means comprises a plurality of tightening screws passing through the flanges of the orifice members belonging to the same port.

6. A chamber filter press substantially as 25 described herein with reference to the accompanying drawing.

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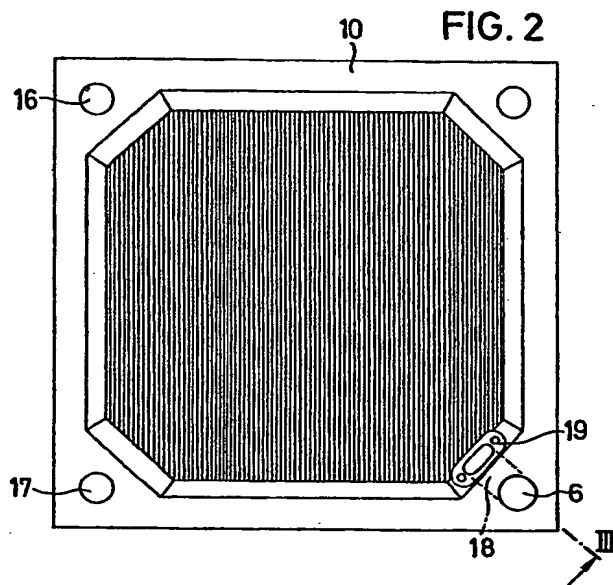
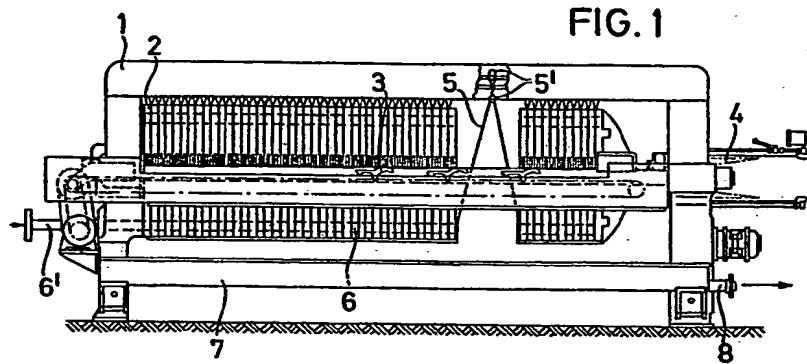


FIG.3

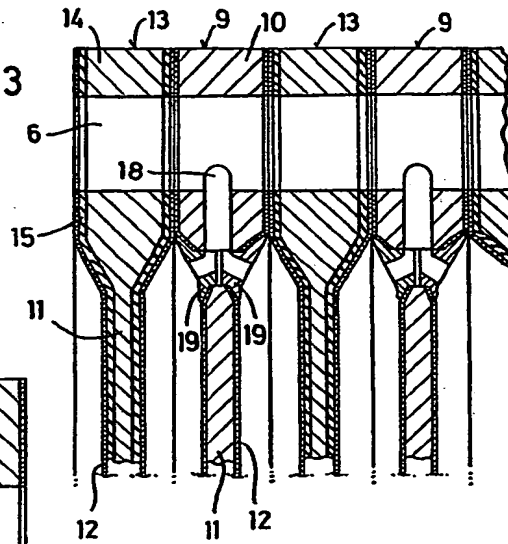


FIG.4

